

ABSTRACT

A microvalve which utilizes a low temperature (<300°C) fabrication process on a single substrate. The valve uses buckling and an electromagnetic actuator to provide a relatively large closing force and lower power consumption. A buckling technique of the membrane is used to provide two stable positions for the membrane, and to reduce the power consumption and the overall size of the microvalve. The use of a permanent magnet is an alternative to the buckled membrane, or it can be used in combination with the buckled membrane, or two sets of micro-coils can be used in order to open and close the valve, providing the capability for the valve to operate under normally opened or normally closed conditions. Magnetic analysis using ANSYS 5.7 shows that the addition of Orthonol between the coils increases the electromagnetic force by more than 1.5 times. At a flow rate of 1mL/m, the pressure drop is <100Pa. The maximum pressure tested was 57kPa and the time to open or close the valve in air is under 100ms. This results in an estimated power consumption of 0.1mW.